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Nudging citizens through technology in smart cities

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ABSTRACT

In the last decade, several smart cities throughout the world have started employing Internet of Things, big data, and algorithms to nudge citizens to save more water and energy, live healthily, use public transportation, and participate more actively in local affairs. Thus far, the potential and implications of data-driven nudges and behavioral insights in smart cities have remained an overlooked subject in the legal literature. Nevertheless, combining technology with behavioral insights may allow smart cities to nudge citizens more systematically and help these urban centers achieve their sustainability goals and promote civic engagement. For example, in Boston, real-time feedback on driving has increased road safety and in Eindhoven, light sensors have been used to successfully reduce nightlife crime and disturbance. While nudging tends to be well-intended, data-driven nudges raise a number of legal and ethical issues. This article offers a novel and interdisciplinary perspective on nudging which delves into the legal, ethical, and trust implications of collecting and processing large amounts of personal and impersonal data to influence citizens' behavior in smart cities.

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1. Introduction

There is a widespread belief that in large urban centers most citizens tend not to know and not to trust their fellow citizens and local institutions (Sadowski and Pasquale 2015). The social capital of newcomers is particularly reduced in cities and not surprisingly, citizen participation in local affairs and interaction with local public actors tends to be limited (Putnam 1995). Citizens are consequently not fully aware of the public services they are entitled to and do not to feel part of the community. Smart cities, that is, urban centers that harness data-driven technology to provide public services, have emerged in this context to address this problem and promote civic engagement, innovation and sustainability (Towsend 2013; Albino, Berardi, and Dangelico 2015). By gathering data on traffic and crowd management, smart cities can, for example, increase the frequency of public transportation during rush hours or special events and offer real-time information on billboards (Kitchin 2014). A closer look at recent policies implemented by smart cities reveals,

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nonetheless, that these urban centers employ technology not only to create spaces of information, trust and active local participation (Iaione 2016) but also to design spaces where citizens can make better and more environmentally friendly decisions, overcoming their bounded rationality and cognitive biases (Gandy and Nemorin 2018).

Richard Thaler and Cass Sunstein's book *Nudge* initiated a long and ongoing debate on the importance of altering choice architecture and policy design to overcome citizens' bounded rationality, nudging them to make smarter decisions (Thaler and Sunstein 2008; Sunstein 2015a). Contrary to traditional public policy instruments such as commands or bans, nudges redirect behavior through slight policy interventions (Mongin and Cozic 2018). Well-known examples of nudges are reminders sent to citizens to subscribe a retirement plan, placing healthy food at eye-level, and changing the order of options presented to citizens in forms so that they will choose the first and the most sensible option. In these examples, citizens retain their freedom to make choices but as their inertia or inclination to choose the default option are assumed, they are put on 'the right path' by a paternalistic policymaker.

A decade after the publication of Sunstein and Thaler' seminal work, it is now possible to combine behavioral insights with digital technology and data science to develop more accurate predictive models that can identify citizens' most common biases, behavioral inclinations, and systematically 'hypernudge' them to choose more wisely (Yeung 2017). Instead of hunches, assumptions or evidence gathered in experiments, big datasets containing processed details on citizens' most likely behavior establish correlations between multiple sources of information. The use of data-driven automated systems allows policymakers to have a broader and complete picture of citizens' lives as these systems can draw conclusions from hundreds of datasets, using large numbers of variables. While the alliance of behavioral insights with smart technology is reshaping local public policy and creating new opportunities for accurate nudging, this article suggests that data-driven nudging also raises novel legal and ethical concerns (Gandy and Nemorin 2018).

The use of data-driven nudges fits within the inherently paternalistic mission of smart cities to improve the quality of life of their residents and deliver services that allow them to live healthy and sustainable lives (Caragliu, del Bo, and Nijkamp 2011; Gandy and Nemorin 2018). This nudging approach is also compatible with the shift from an institutional concept of smart city to a more experimental approach to smart cities that perceives citizens as informed decision makers (Evans, Karvonen, and Raven 2016; Calzada 2018). In an institutional approach to the smart city, citizens are regarded as passive data subjects whose data is put at the service of the functioning of the urban center and its infrastructures. Personal and urban data on the amount of pedestrians or vehicles feeds smart devices and allows them to operate. In an experimental approach to the smart city, citizens are involved in the management of urban goods (Calzada 2018) and the co-creation of more sustainable projects. According to this perspective, smart cities have to redefine themselves and experiment with new ways of thinking about constantly evolving technology and use it to advance the common good and social welfare (Angelidou 2017). Nevertheless, in practice, the mentioned nudging approach also places additional emphasis on the need to promote welfare in the city without relying on broad democratic participation, digital fairness and justice, and transparency (Iaione, de Nictolis, and Suman 2019).

The use of data-driven nudges and behavioral insights in urban centers has remained sparsely studied in the literature (Gandy and Nemorin 2018). Nevertheless, several smart cities throughout the world are currently combining behavioral insights with technology,

in particular, Internet-of-Things ('IoT'), big data, and artificial intelligence, to nudge citizens to behave and consume public services (*e.g.* transportation) in a more sustainable way (Gandy and Nemorin 2018). For example, in Eindhoven, in the Netherlands, the city has conducted a number of successful experiments with sensors in areas known for nightlife crime and disturbance. By collecting and processing real-time information and relying on behavioral insights, this smart city tried to influence individuals' behavior by altering the intensity and color of street lighting (Hoogeveen et al. 2018). The IoT sensors adjusted the lights to the predicted mood of pedestrians in order to nudge them to calm down or take different routes.

Despite the alleged good intentions of data-driven nudges (Yeung 2017), this article suggests that the ubiquitous collection of personal data with IoT, the use of big data and complex algorithms to nudge citizens to behave in a certain way can be problematic from a legal and ethical perspective (Edwards 2016; Peppet 2014). The protection of the right to privacy of citizens as well as their individual autonomy may be endangered if intrusive data-driven nudges open the doors to profiling and other discriminatory practices (van Zoonen 2016; Wachter 2018). In addition, ongoing debates on the ethics of nudging have raised awareness for the thin line that separates nudging from the manipulation of choice and the lack of transparency regarding underlying intentions (Bovens 2009). These concerns are particularly present in cities where data-driven instruments (for example, the case of light sensors in Eindhoven) tend to be developed by smart cities in close collaboration with profit-driven private corporations such as IBM, Alphabet or Palantir (Brauneis and Goodman 2018; Ranchordás 2018). In the context of public-private partnerships or outsourcing of public services, legal and ethical concerns may include questions regarding who should have legitimate access to collected data, what data can be released to public usage and whether this data should be processed for the development of data-driven nudges (van Zoonen 2016).

This article inquires into the potential and legal implications of data-driven nudges in smart cities. It draws on interdisciplinary literature and policy reports on urban law (*e.g.* Frug 1980; Nicola 2012; Davidson and Tewari 2018), behavioral law and economics (Feldman 2018; BIT 2018), smart cities (Kitchin 2014) and smart technology (Hildebrandt 2015, 2016). This article fits within recent research that has delved not only into the governance and regulation of algorithms and big data as such but also into how and to what extent smart technology may be employed to reshape the regulation and governance of society (Just and Latzer 2017). Furthermore, this article joins the literature which has voiced criticism towards the corporatization and technocratic governance of cities (Calzada and Cobo 2015; Hollands 2015; Kitchin 2016).

This article's contribution to the existing legal literature is threefold: first, it offers a novel analysis of how local governments can combine data-driven technology with behavioral insights to redesign local policy; second, it delves into the legal and ethical implications thereof; third, it explores how technology is reshaping the relationship between citizens and smart cities.

The remainder of this article is organized as follows. The first section defines nudges and provides a brief overview of how behavioral insights have been used in law and policymaking in the last decade. The second section explains how smart cities are employing data science, IoT, big data and predictive analytics to better understand and influence citizens' needs, cognitive biases and behavior. The third section explores the legal and ethical

challenges of employing data-driven nudges and the fourth concludes and reflects upon the question whether data-driven nudges are contributing to more citizen-centric cities or whether this nudging approach is instead undermining the trust that citizens have in local institutions.

2. Behavioral insights and public bodies

2.1. Introduction to choice architecture, nudges, and behavioral insights

Choice architectures, that is, the way in which potential decisions are designed and presented have always existed and are, to a certain extent, inevitable (Thaler and Sunstein 2008). These frameworks shape to a great extent our decisions because decision-making is not always rational. Contrary to traditional rational choice economics, behavioral economics has shown that individuals often choose the easiest route, the default answer or the first option they are presented with. Moreover, individuals rely on heuristics and are easily influenced by their cognitive biases. Pedestrians tend thus to take escalators rather than stairs even though they would rationally know that the latter is not the healthiest option (Thaler and Sunstein 2008). In many cases, these rules of thumb are reflections of our bounded rationality (Simon 1955; Tversky and Kahneman 1981; Kahneman 2003). Instead of promoting self-control and additional reflection, urging citizens to make more rational decisions or advocating the prohibition of 'unhealthy' behaviors, Thaler and Sunstein have argued that changing their choice architecture and adopting nudges may have an equally important and positive influence on citizens' behavior (Thaler and Sunstein 2008).

The concept of nudge and the different types of nudging interventions have been widely discussed in the legal literature in the last decade (Baldwin 2014). Sunstein and Thaler define nudges as 'any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives' (Thaler and Sunstein 2008; Thaler 2015). Moreover, 'to count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates' (Thaler and Sunstein 2008). A nudge steers individuals in a particular direction without imposing any regulatory or financial sanctions: for example, a city screen with real-time information on the traffic conditions, warnings or reminders of the bad weather may be qualified as light nudges, while a speed limit does not as it involves the application of a regulatory sanction (Sunstein 2015a).

Nudges are non-regulatory measures that aim to influence an individual to change her behavior through subtle and cost-effective changes in her environment (Oliver 2013). A nudge does not reduce in theory human agency since freedom of choice is not removed (Sunstein 2015b). The nudge approach has been described as 'libertarian paternalism' as the government redesigns choices in a paternalistic way to make it easier for citizens to decide but leaves the ultimate decision to the individual (Sunstein and Thaler 2003; Hansen 2016). Nudges help individuals overcome any potential biases or errors [the so-called paternalistic nudges] that could result in making irrational choices (*e.g.* walking through a less safe neighborhood). Other nudges respond to market failures such as the need to promote better waste sorting or incentivizing the production or purchase of green energy.

Traditional nudges seek to alter behavior in a predictable way based on systematic and frequently observed behavioral findings (Thaler and Sunstein 2008). A well-known example is the organ donation system opt-out system: since it has been proven that citizens tend to choose default options, some governments wishing to increase the number of organ donors, register their citizens such, assuming that this is their preference. (Cohen 2013). Citizens are notified that they may wish to opt out but as these governments rightly had predicted, few will do so. Nudging in health policy challenges the autonomy of patients as it may be regarded as a manipulation of their flawed rationality but it also helps overcome important problems in the context of giving informed consent (Cohen 2013).

In recent scholarship, Sunstein (2015b, 416–417) has underlined that not all nudges aim to combat behavioral biases, some aim to provide additional information. In practice, nudges can take up this less intrusive form of reshaping policy design. The most common forms of nudges are communication nudges (*e.g.* reminders) and information-framing nudges (*e.g.* placing favored options in bold letters). Recent literature has designed different categories of nudges. Mongin and Cozic (2018, 108)) distinguish between three types of nudges: Nudge type 1 is an intervention that interferes with the choice conditions minimally; Nudge type 2 is an intervention that uses rationality failures instrumentally; and Nudge type 3 is a welfare-promoting intervention that tries to reduce the negative effects of rationality failures. While Nudge type 1 (*e.g.* placing larges traffic signs or additional light poles on cycle paths to promote cycling) may not interfere with existing legal frameworks or individual autonomy, as this Article will later explain, nudges type 2 and 3 may have more serious legal and ethical implications.

Nudges have been suggested as valuable approaches that can be employed as complements rather than alternatives to traditional policies (Benartzi et al. 2017). Complements to policymaking can nonetheless work as 'warning labels' that reshape how individuals envision certain problems and decide what policies to adopt. Moreover, empirical research is required in multiple fields to determine the relative effectiveness of nudging. The impact of nudges on individual decision-making may be highly dependent on a number of factors such as the presence of counteracting marketing (*e.g.* in the food industry) (Lehner, Mont, and Heiskanen 2016) and the availability of other options. The literature has also demonstrated that the likely public acceptance of nudges may equally be determined by cultural aspects, geographic features, educational background, and household characteristics (Loibl et al. 2018). In general, nudges that reflect customs or habits tend to be well-accepted, while choice architecture that reflects otherwise may not easily be trusted (Sunstein 2015a).

Nudges are distinct from other forms of paternalistic policy instruments or regulation: for example, a tax on sugar or a cap on the size of soda drinks may be inspired by the same behavioral insights as a nudge, that is, the effectiveness of redesigning the options individuals are presented with. However, the former are not nudges as they reduce the freedom of choice of individuals, are based on a regulatory intervention and have financial implications for citizens (Friedman 2013). A tax or a prohibition on products reshapes decision-making by effectively reducing the options consumers are given. Instead, a product placed at eye-level or a pre-filled in form are more convenient products but nothing impedes consumers from preferring an alternative. The next subsection shows the growing practical relevance of this behavioral approach to law as it provides

an overview of how public and private actors are relying on behavioral insights to influence decision-making.

2.2. Behavioral insights for better public and private decisions

In the last decade, private companies have been turning to behavioral insights in order to understand how their workers and consumers think and behave. Through extensive data collection and processing, large corporations have relied on these insights to improve their performance and personalize products offered to consumers. Public bodies and in particular cities, have also become increasingly interested in behavioral science as behavioral insights and interventions in choice architectures promise fast and better decisions at low cost to governments (Glowacki 2016).

Both the United States and the United Kingdom have openly embraced the nudge approach, relying on this theory to redesign policies (*e.g.* the 401(K) pension scheme in the United States) or address important social issues (*e.g.* high levels of alcohol consumption among the British youth) (Hansen and Jespersen 2013). Although at the time of writing the United Kingdom is the only European country with an established behavioral insights team (or 'nudge unit'), other countries (*e.g.* Denmark) are also developing similar ad hoc policy initiatives (Lourenço et al. 2016). In the last decade, partially due to greater developments in cognitive science and behavioral law and economics (Jolls, Sunstein, and Thaler 1998; Zamir and Teichman 2014; Thaler 2015), behavioral insights have gained additional legitimacy and have been employed to improve the quality of decision-making and influence citizens to overcome their biases (Yeung 2012).

National and local governments are adopting behavioral insights and applying it to a broad range of government areas, including revenue collection, transparency, public health, civic engagement, police recruitment, and water conservation. To illustrate, Toronto has employed nudges to encourage changes in citizens' behavior, in particular to reduce waste disposal in the city. While there is empirical evidence suggesting the effectiveness of nudges in this area, recent research also shows that nudges can be particularly effective in encouraging people who were already prone to adopting a certain good behavior (*e.g.* use reusable bags) but they cannot nudge citizens for whom environmentally friendly decisions are not already ingrained in their system (Rivers, Shenstone-Harris, and Young 2017). The same study also revealed important limitations for nudging policy in a broader context as the effects of certain sustainability policy nudges appear to be more effective in high socio-economic households rather than among citizens with more limited income, precarious housing situation, and lower education. The behavioral insights used to improve policymaking resulted until recently from either scientific findings (for example, in behavioral research) or the experience of policymakers. As the next subsection explains, big data and the use of predictive analytics have allowed public and private actors to make predictions on individual's default choices based on the data collected specifically on them or, more commonly, on crowds.

2.3. Nudging meets technology

The publication of *Nudge* about one decade ago inaugurated a decade of scholarship on the role of nudging in law and policymaking (Alemanno and Sibony 2015; Hansen

and Jespersen 2013; Mathis and Tor 2016; Feldman 2018). The nudge theory has regained popularity not only due to the recent award of the Nobel Prize for Economics to Richard Thaler but also because this theory addresses the current disenchantment with traditional institutions and regulation by promising a less intrusive intervention in the regulation of behavior. Nudging approaches also reflect the shift from the market and its failures to citizen-centric approaches where more attention is devoted to behavioral biases (Berndt 2015). This is particularly true in the context of local governance as smart cities have started underlining that technology may empower citizens to lead more meaningful, healthy and sustainable lives (Cowley, Joss, and Dayot 2018). Nudges also offer a cheaper means of dealing with social problems (Burgess 2012). More importantly, nudges have received renewed attention due to the availability of smart technology that allows policymakers to apply nudging more systematically precisely in the contexts where they will be effective (Hansen and Jespersen 2013).

Behavioral insights have been combined with smart technologies in the last decade in the private sector. Large corporations predict the likely behavior of their consumers for example by giving meaning to the data collected by IoT sensors (*e.g.* smart fridge) with the help of big data and algorithms. They offer targeted advertisement, adjust prices to their willingness to pay or personalize their products in other ways that may captivate the attention of consumers. Corporate companies draw on this ubiquitous data collection to develop light nudges such as reminders to stock up an empty fridge, take medications or take a break during a long trip (Peppet 2014). Wearables companies can also use biometrics gathered from a user's smartphone or wearable devices to deliver personalized nudges. Corporations such as Amazon have employed big data and artificial intelligence for a number of years to nudge citizens to buy certain products or walk through specific aisles of stores (Carolan 2018). Data-driven nudges allow for companies to influence consumers in a consequential manner and with a greater degree of precision (Carolan 2018). Corporations can also employ image recognition, predictive analytics, and pattern cognition to cluster groups of consumers according to their behavior and nudge them accordingly.

Governments are also relying on the same technology to improve how they make decisions and to influence citizens to overcome common biases. Thanks to the data collected on individuals' daily routine (for example, through a connection to city Wireless network), public and private actors can send emails to citizens or consumers when they are for example in the vicinity of a certain facility or at a certain time (*e.g.* sports event). Nowadays, policymakers do not need to guess citizens' preferences. Instead, complex networks of millions of 'smart devices' (IoT) in constant communication, will give them access to solid information on what drives citizens with a greater degree of precision than any behavioral experiment would (Yeung 2017). Governments can now collect and process large datasets and use algorithms to make more accurate predictions about individuals' likely actions and preferences (Pasquale 2011). Smart regulation and policy are thus increasingly informed not only by clinical predictions based on academic research, experience, or anecdotal pieces of information, but also by data collected and processed by predictive analytics.

3. Smart cities, technology and nudges

There is no consensual definition of 'smart city'. Instead, the notion of smart city is an elusive concept that may intrinsically be related to the local culture, available technology, and the established priorities of the times. To illustrate, the adjective 'smart' of this urban label has been preferred to other synonyms as in the business and marketing literature, 'smartness' conveys better the focus of the city on the user experience and the need to address citizens' needs (Nam and Pardo 2011).

The literature has offered multiple descriptions of the goals or key elements that a 'smart city' should aspire to (Albino, Berardi, and Dangelico 2015; Angelidou 2017). Some definitions are based on the ability of a city to promote innovation and economic growth, others focus on the development of better infrastructure, and others associate smartness of cities with serious investments in the quality of life of their citizens (Albino, Berardi, and Dangelico 2015). In the work of Andrea Caragliu and others (2009), 'a city is smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.' Lombardi and others (2012) consider that 'the application of information and communications technology (ICT) with on the role of human capital/education, social and relational capital, and environmental issues is often indicated by the notion of smart city.' None of these definitions fully captures the various tensions that characterize the dynamics of a smart city. Moreover, the elusive character of the smart city is not a merely conceptual problem. Rather, the focus on technological change, the inability to address the interests of different stakeholders, match services with citizens, and solve the multiple tensions that are always present in any large urban center, tend to be the Achilles heel of smart city.

In this article, smart cities are defined as urban centers where local institutions implement smart technologies (IoT, big data, AI or ML, blockchain, virtual reality) to advance the innovative character of the city and improve the inclusion, participation, and well-being of citizens. Smart cities embody two new governance trends: the reliance on an entanglement of smart technologies to advance the public good and the growing collaboration between the public and the private sectors to develop innovative projects with limited costs (Jewell 2018). In a smart city, technology and traditional infrastructures are merged in order to improve the quality of life of its citizens and commuters and stimulate the development of social, economic and ecological areas of urban environment.

Smart cities rely upon complex networks of interconnected sensors that keep permanent track of life in an urban center center, draw connections between different data segments and establish data chains. Smart cities can save costs by creating data interactions and identifying correlations between different data sets. Smart cities try to find patterns in big datasets and use predictive analytics to adapt their services to the established needs of the city (Brauneis and Goodman 2018). To illustrate, drawing on big data sets, cities can identify the areas where petty theft is more likely to occur and allocate more police officers to prevent crime (Joh 2016; Ferguson 2017).

IoT sensors allow for the identification of information, connectivity, visual representation, combine real-time data/information flows (Ng and Wakenshaw 2017). Smart cities collect nowadays vast amounts of personal and urban information through smart

grids, video surveillance and municipal smartphone applications (Hiller and Blanke 2017). In a smart city, a visit to the garbage bin will probably not go unnoticed: sensors placed in garbage bins will register how often garbage has been deposited and, in some cases, they will be able to identify the type of garbage placed inside the container (*e.g.* paper, glass, waste). Large cities like Barcelona, New York City, and Sydney also analyze this data for garbage collection route planning. In Australia, RFID (Radio Frequency Identification Device) chips placed in rubbish bins detect whether they are full and need to be collected (Kitchin 2014). The same type of technology and data collection are also active in other policy areas in smart cities.

Some of the tensions experienced by smart cities can also be explained by the shift to a new digital-era governance which has been characterized by the increasing digitalization of policy documents and administrative processes, the establishment of open government platforms, and, more importantly, the reaggregation of public services under direct government control around the citizen. Data-driven nudges should also translate this idea of citizen-centric services that aim to serve the citizens' best interests. This section provides a two-step overview of how smart cities are relying on behavioral insights to nudge citizens to live healthier and more sustainable lives: first, through a description of how data is collected in smart cities, and second, by analyzing how cities are implementing nudges.

3.1. Smart cities: mission and technology

The traditional narrative of smart cities involves the promise to deploy digital technology for the benefit of their entrepreneurs, citizens, and visitors and harness different forms of technological advancements to address key urban challenges (Kitchin 2014). This narrative focused on technological improvements, efficiency, and technocratic governance and emerged in stark contrast to regular cities. In regular 'offline' cities, information was not consistently collected and when it was digitized, the data would be stored in silos or as separate units: data on garbage collection or sewage would not be connected to data on energy use, data on the water management would not 'talk' to data on housing policy. With the first technocratic wave of smart cities, public authorities aimed to automate functions, make evidence-based predictions on crime occurrences rather than on experiences, distribute city resources efficiently, and monitor the city (Batty et al. 2012). However, the focus on efficiency only conveyed one of the many values of the city. More recently, a citizen-centric narrative emerged. In this context, smart cities seek to balance efficiency with equity and hence improve the quality of life of citizens into real time (Batty et al. 2012). Public authorities employ technology not only to monitor the city but also to understand it.

The combination of interconnected technologies and the establishment of collaborations between different stakeholders allow the city to have a clear image of how citizens and visitors behave. Batty et al. (2012, 513) have suggested that we are witnessing the emergence of a new 'science of spatial behavior' as routine data in real time is producing big datasets which deliver valuable and complete information on apparently unrelated city elements and citizens' behaviors. Drawing on behavioral insights, technology can also help public bodies understand how citizens could behave better, what their decision-making biases are, and how they can advance the mission of the smart city. In

a smart city, citizen-centrism should encompass active and informed participation, citizen-friendly mobility, services, and communication (Olaverri-Monreal 2016).

Research on ten European smart cities concluded that the success of these urban centers was partially determined by the active participation of people as this created a sense of ownership and commitment (European Commission 2014). It is well-known that smart cities try to appeal in particular to the most creative segments of society. These cities develop innovation-friendly ecosystems that can attract entrepreneurs, foster competitiveness and productivity. The mission of these urban centers also extends to their different citizens as they seek to create a more informed, active, and inclusive citizenry (Towsend 2013; Kitchin 2014).

Smart cities also aim to promote civic engagement by relying on the collective intelligence. Citizen reporting applications ('311 apps') and 'crowdsensing' are among the most common forms of drawing on the knowledge unevenly dispersed among the members of society (Hayek 1945). In the case of 311-apps, smart cities invite residents and visitors to participate in the management of local affairs by developing smartphone applications that allow citizens to report local incidents and provide suggestions to local government (Shkabatur 2011). These applications function as a simple and effective contact point for non-emergency services and welcome the input of citizens Several smart cities enhance this network effect with free public Wi-Fi coverage to residents and visitors.

Smart cities also employ technology to solve a key challenge faced by local government: the difficulty in matching citizens' needs with public services, improving the quality of these services, and making government requests more effective (Behavioral Insights Team 2018). Many citizens in need might not know exactly what services and benefits they are entitled to or may not have the educational background to make the most sustainable choices. Moreover, the traditional technocratic and technology-centered discourse on smart cities often fails to see the misalignment between technology and the social needs of citizens, in particular less tech-savvy individuals (Calzada 2018). In the last decade, this narrative has been replaced by the need to offer more citizen-centric services where citizens are engaged in the co-creation of public services and the management of public goods. Citizen-centric services engage citizens in the governance of the city as well as its commons and regards technology as a means to empower individuals to collaborate with public authorities (Joss, Cook, and Dayot 2017). This citizen-centric approach underlies the use of many IoT-applications that transform the smart city into a safe and secure ecosystem (de Waal and Dignum 2017). It is, nonetheless, unclear whether technology or policy priorities will convert local services into citizen-centric spaces and whether nudging approaches will promote or undermine this goal.

3.2. Smart cities and nudges

As Gandy and Nemorin explain (2018, 2), smart cities aim to correct the 'market failures' of urban centers in a similar way to nudges. Smart cities and nudges aim at welfaristic ideals and offer an alternative for a better, wiser, more sustainable and healthier life (Feldman 2018). In a smart city, the use of public transportation and other environmentally friendly actions are promoted through smart devices (*e.g.* mobility smartphone applications). A traditional nudge approach, as advocated by Sunstein and Thaler (2003) changes the choice architecture of individuals to make it easier for citizens to make the 'right' choice (*e.g.* take

public transportation). Urban spaces also have inevitable choice architectures that determine how their citizens and visitors behave at a certain time of the day and location (*e.g.* urban planning, public transportation routes). In recent years, both approaches have been merged as smart cities have started realizing that technology could be used not only to collect data and inform citizens but also to nudge them to change their behavior. Indeed, the general performance of certain smart city policies such as urban energy systems or waste separation is to a great extent dependent on the behavior of individuals (European Commission 2014). No regulatory intervention or policy can work effectively if its impact on the behavior of targeted individuals is not considered (Jolls, Sunstein, and Thaler 1998; Hayden and Ellis 2007). It is estimated that most sustainability problems such as water and air pollution are rooted in human behavior and, in particular, that of urban residents (Linder, Lindahl, and Borgström 2018).

Addressing the behavior of individuals can thus have a significant impact on the execution of a smart city policy. While in villages social control has always been just as effective as any form of prohibition of IoT surveillance device, in cities, individuals are strangers and their behavior tends to get lost in the collective memory. Nowadays, the daily behavior of citizens is digitally captured and processed through networks of sensors. Cities have become aware of the fact that having this information could help them obtain insights about undesirable and unsustainable behavior and assist them in creating recommendations that promote better decisions (Eggers, Guszcza, and Greene 2017).

A number of smart cities throughout the world has drawn on the collected and processed data to develop primarily communication or informational nudges that provide information and offer feedback. In multiple cities (*e.g.* Sacramento, Sheffield, Johannesburg), nudging approaches include sending letters to residents comparing their energy consumption to that of their neighbors (Kasperbauer 2017). These communication nudges as well as other form of providing positive or comparative feedback draw on the behavioral insight that individuals are more likely to change their behavior with this strategy than with criticism or sanctions. This type of nudge approach has the potential of being effective because individuals' preferences are, on the one hand, endogenous in the sense that they are influenced by the choices of others (Buckley 2009; Yeung 2012). On the other, citizens tend to be competitive and try to outperform their neighbors or other peers. More recently, this nudging approach to sustainability has been made possible by smart meters or the installation of smart grids (Nordic Council of Ministers 2016).

Durham, North Carolina, has employed data-driven informational nudges by partnering up with several large corporations and employers to nudge citizens to choose public transportation over their private vehicles. The city emailed personalized route maps from individuals' homes to work, showing different private and public transportation options. The effectiveness of informational nudges can be combined with feedback elements. Boston, for example, has introduced a smartphone application ('Boston's Safest Driver') that provides feedback on driving based on speed, acceleration, braking, cornering, and phone distraction. This application collects personal and urban data on traffic safety and rewards careful drivers with weekly prizes to the safest driver in an effort to promote safe practices (Resutek 2016). Enschede, a medium-size smart city in the Netherlands, has installed city traffic sensors that can register how often individuals visit the city and

where they go. The city has developed smartphone traffic and cycling applications (*e.g*, SMART-app: Self-Motivated and Rewarded Traveling) that encourages individuals to cycle through alternative routes, rewards them for good behavior if they walk, cycle or take public transportation instead of driving. This strategy might not be a typical example of a nudge '*stricto sensu*' as citizens also receive a material reward for their good behavior (*e.g*. free bicycle check-up service). Interestingly, in this and other cities, citizens are rarely aware of the fact that the collected personal data belongs to a private company (*e.g*. Mobidot, Alphabet).

The example of Stratumseind (nightlife street) in Eindhoven is another illustration of the use of smart technology to nudge behavior in smart cities. This street is fitted with wifi-trackers, cameras, microphones that can detect aggressive behavior, and smart street lights that change light intensity to calm individuals. The city also plans to diffuse relaxing scents to alter the mood of people that could potentially start altercations after a night out.

4. Legal and ethical problems

Nudges are often regarded as policies interventions with limited legal implications (Calo 2014). Rather, they are qualified as soft policy choices which are made within the scope of the discretionary powers of policymakers (Oliver 2013; Alemanno and Spina 2014). As explained earlier in this article, some types of nudges have indeed a very limited legal relevance as they only rearrange choice architectures. However, several nudges are simply difficult to categorize: some manipulate choices (*e.g*. policy interventions to reduce smoking), others provide information (*e.g*. signs warning against side-effects of tobacco) (Calo 2014). Regardless of the category at stake, it is important to underline that nudges are communication vehicles and the communication between citizens and the state does not occur in a legal vacuum (Alemanno and Spina 2014). The same is valid for the data collection which is necessary to develop data-driven nudges.

This section addresses four intertwined legal and ethical concerns related to data-driven nudges in smart cities: the violation of the right to privacy and the potential conflict with existing legislation, namely the General Data Protection Regulation ('GDPR'); the safeguard of administrative and procedural rights of citizens before the public administration; the risk that smart cities may act beyond the limits of their public powers; and finally, the limitation of of individual autonomy.

4.1. Legal concerns

4.1.1. Privacy

Much of the data collected in smart cities is not personal as it refers to crowd management, urban or environmental data (*e.g*. levels of air pollution, traffic density). Moreover, much of the data that is collected by smart cities is then published in open data portals to improve the functioning and accountability of public services. At first blush, the use of impersonal data to nudge citizens is generally regarded as unproblematic. To illustrate, if a smart city would like to nudge crowds to walk through less popular streets in order to decongest shopping streets, it can use sensors to change street illumination without the need to rely on personal data. In 2017, Privacy International unveiled nonetheless a number of privacy concerns resulting from large data collection in smart cities. In its

report, Privacy International (2017, 19) referred to a study conducted by the London underground to track users throughout their journey using WiFi, it appeared that there were plans to generalize this tracking and sell this data to third parties.

Privacy concerns also arise from the technological challenges connected to the separation between urban and personal data. These concerns arise here from the increasingly detailed methods of profiling and the deficient existing anonymization tools which may facilitate the re-identification of individuals from aggregate and anonymized data (van Zoonen 2016; Wachter 2018). In this context, the protection of privacy of individuals in smart cities refers not only to the dimension of protecting access to data but also to a second dimension: the knowledge which is inferred from the collected data (van Otterlo 2014).

The use of IoT allows smart cities to connect data between an individual's smartphone or wearables and the sensors placed throughout urban spaces. The interoperability of devices allows public bodies to have a good perception of how the city lives. Nevertheless, despite claims that cameras and microphones are mostly used for crowd management and that information will be anonymized, the risk of profiling lurks around the corner (Wachter 2018). While a data-driven nudge may not be as intrusive as other forms of policy intervention, the risk of discrimination in nudging is real as profiling techniques may result in personalized nudges embedded in stereotypes.

Citizens' data is collected 24/7 for specific purposes such as to provide real-time information or improve the frequency of public transportation. However, in a 'nudging smart city' the use of the data will not always remain confined to the traditional information silos. A number of questions regarding the protection of the privacy of citizens will then arise: is it necessary and legitimate to collect data to nudge citizens? Has only the very minimum amount of data been collected? If the smart city works together with a private corporation to collect and process the data, who owns the data and what kind of contracts do these entities have with public bodies? Do citizens feel that their right to privacy is being respected when their data is being collected in order to develop nudges that will be employed to change their behavior? Some of these questions can be explained by a conflict of data collection purposes and the potential violation of the principle of transparency (article 5 General Data Protection Regulation, 'GDPR').

The principle of transparency aims to guarantee that data collection technologies operate in 'an open and auditable manner, with clear documentation and clarity on how information is handled' (Privacy International 2017). The principle of transparency is an overarching principle of data collection and EU law which aims to engender trust in the processes which affect the citizen. This principle is also an expression of the principle of fairness in relation to data collection (article 8 of the Charter of Fundamental Rights of the European Union).

The data collected by the technology put in place by smart cities is originally meant to manage the efficiency of public services, rather than to influence the decisions of citizens. To illustrate, citizens may consent to the collection of their personal data for the purposes of monitoring garbage collection services, traffic flow or national safety (Edwards 2016). Data-driven nudges rely, nonetheless, on the same data as policymakers can draw on established patterns to make recommendations and develop nudges. Data-driven nudges – at the resemblance of any offline nudges – tend to work better when they

are covert and citizens are not aware of their existence. Nevertheless, citizens' consent on data collection for the management of garbage collection may not necessarily be extended to data-driven nudges that wish to influence them.

Data-driven nudges that operate in a non-transparent way could rarely comply with the GDPR requirements of transparent data collection and processing as citizens would have to be informed of this secondary and possibly unrelated potential use of the data. The principle of transparency also requires openness of processing operations so that citizens can hold data controllers accountable and are allowed to withdraw their consent.

The GDPR also requires both public and private entities to ensure that data collection and processing remains within the limits of the necessary performance of a task in the public interest as defined by law (Articles 5 and 6 (1) GDPR) (Blume 2015; Butler 2018). Smart cities work often together with private actors to collect and process data through different technologies. The use of interconnected devices and networks that are managed by public and private parties is nonetheless problematic. Smart cities rely on private technology corporations (*e.g.* IBM, Alphabet) as a form of reducing costs, overcoming the lack of expertize in their local IT-departments, and outsourcing the management of technology. Nevertheless, the increasing reliance on hybrid governance and extensive public-private networks raise additional concerns such as the lack of transparency of data, accountability of data custodians, the unwarranted delegation of public tasks to private actors, and the protection of the public interest (Maher 2007; Osofsky and Wiseman 2014). It may be thus argued that data-driven nudges developed by cities and private corporations may be not only a reflection of the public interest at a given time but may also be influenced by the interests of profit-oriented corporations.

In 2017, Privacy International invited local governments to rethink this reliance on private corporations for the collection of data in smart cities and reflect upon their ability to keep public oversight in the context of smart city governance. Privacy International underlined that local governments need to reflect on what they may be giving up, whether they retain control over the data and whether they remain able to audit and control the systems (Privacy International 2017). Also in the context of the principle of data minimization, Privacy International suggested that governments should ensure data is collected only when strictly necessary to deliver the services that their citizens need. This begs the question whether data collection for the purpose of nudging citizens should be excluded or whether data collection actions should be limited to certain types of nudges that can translate themselves in significant improvement of the quality of life in cities and services. In addition, it can also be questioned whether public officials should not have more respect for the context in which data is collected and the limits imposed by the principle of contextual integrity (Nissenbaum 2018). In 2004, Helen Nissenbaum argued that individuals should be protected against unjustified intrusions of public agents that affect their liberty and autonomy. While Nissenbaum's analysis of contextual integrity does not encompass light forms of nudging, it warns us against widespread data collection for the purposes of designing intrusive types of nudges that have a significant but obscure impact on individual decision-making (Nissenbaum 2004).

4.1.2. Democratic legitimacy, accountability and autonomy

The adoption of data-driven nudges raises important concerns related to their democratic legitimacy and accountability as behaviorally informed regulation and policy interventions

can potentially interfere with the principle of individual autonomy (Alemanno and Spina 2014). Data-driven nudges can be scarily systematic and leave little room for choice, producing a result similar to that of a profiling policy or, in extreme cases, an administrative decision. Influence and persuasion imply the existence of public powers and their proportionate exercise, particularly when nudges interfere with fundamental rights such as the freedom of expression and the right to information self-determination (Alemanno and Spina 2014). In addition, nudges are not always transparent as they tend to work better when citizens are not aware of them (Bovens 2010). A nudge is thus not a neutral, open, complete, and accurate instrument of public communication (Fairbanks, Plowman, and Rawlins 2007). Instead, at the resemblance of political propaganda, nudging contains a clear ideological component which aims to persuade citizens to behave in a certain way. At the resemblance of any other form of administrative intervention, public officials have a duty to pursue the public interest with openness and transparency, even when it comes to nudging and other behavioral instruments (Sunstein 2015a). The level of required transparency should not endanger the effectiveness of the nudge, but nudging does not allow officials to nudge in any given direction for the purposes of social ordering (Oliver 2013). Depending on the type of nudge, this instrument may interfere with the informational self-determination of citizens and 'their right to be left alone' in their inner decisional sphere, specially if they are not causing any harm to others (Yeung 2015).

Nudging displays a form of asymmetrical power which is typical of the state but contrary to regulatory interventions, nudges are not always counterbalanced by democratic checks and balances. They are designed by public officials, behavioral teams or private companies hired to collect and process data. Contrary to the novel experimental narrative of the smart city, citizen participation tends to be limited in this context. When nudges are thought to have a positive effect on the improvement of the welfare of city inhabitants, broad and democratic consensus should be sought in the community, for example, in a city council. Evidence-based policy and impact assessments can help policymakers decide whether they should nudge citizens (Privacy International 2017), what kind of nudges should be employed, and what technological means they need to have at their disposal for this purpose.

4.2. Ethical concerns

The combination of big data, AI, machine learning, and behavioral insights may facilitate the process of effectively nudging citizens but as smart technology evolves, it is important to revisit not only the ethics of nudging but also the ethical standards of smart cities.

In the last five years, the ethical dimension of smart cities has received increasing attention as it has become apparent that the policy of several smart cities lacks ethical supervision, citizens have little say on how the priorities of smart cities are defined and how their data is collected for the pursuit thereof. In addition, cities are becoming increasingly privatized and are handing over the control over public services and citizen data to large corporations (Kitchin 2016; NESTA 2018). Public-private partnerships established in the context of smart cities fail to address the ethical dimension of cities governance and rarely deal with the public oversight of citizen data (NESTA 2018). Although cities rely heavily upon personal data to improve the quality of public services, they do not

always treat data as a public good that should not be outsourced without a transparent data policy strategy (NESTA 2018). These ethical concerns grow as personal data is used to influence citizens' behavior.

Cass Sunstein (2015a, 413–414) argues that nudging may be ethically required when the promotion of welfare is the key priority of government. Nevertheless, not all nudges can be justified by the maximization of welfare as some nudges focus on social goals that are prioritized at a certain time and place, may promote the interests of the beneficiaries of a specific policy rather than the community as a whole (*e.g.* organ recipients), and they may generate externalities (Guala and Mittone 2015). Moreover, despite these welfaristic arguments, individuals should be given a fair opportunity to resist, ignore or reject nudges. With the ubiquitous presence of technology, individuals are left with little room to make autonomous. As smart cities become able to influence cognitive patterns with greater accuracy, public institutions can not only rearrange the choice architecture but will also leave little to no choice to human agency (Viljanen 2017).

When technology is used to 'hypernudge' citizens with obscure nudges, one could ask where to draw the line between a nudge and an attempt to manipulate citizens. In order for a nudge to be manipulative, it has to distort the decision-making process. 'Nudges have a genuine escape clause' and they will not be perceived as manipulative if the nudged individuals have consented to it. Nevertheless, nudges tend to be more effective if citizens are not aware of them. Nudges will necessarily contain a slight form of manipulation – particularly data-driven nudges that rely upon vast amounts of personal information – as they take advantage of the fact that individuals tend to act unreflectively, to follow crowds, and do not always to take time to reflect before deciding (Yeung 2012). The idea of nudging assumes a compliant environment (Burgess 2012).

The majority of ethical objections raised in the literature against the use of nudges revolve around the idea that these instruments may manipulate decision-making, undermine rather than promote individual autonomy and dignity (Rebonato 2012) and lack transparency (Bovens 2009). Nudges may, nonetheless, also be rejected because citizens do not trust the institutions that are nudging them (Room 2016) if they do not agree with their values or feel that they are not involved in the decision-making process (NESTA 2018).

In the specific case of smart cities, ethical problems and the lack of trust in local government also arise because of the collaboration between local governments and profit-oriented corporations that support or develop the technology required to nudge citizens (van Zoonen 2016; Hiller and Blanke 2017; Brauneis and Goodman 2018). Cities procure smart technologies without seeking the consent of local communities, inquiring into their values or promoting the participation of citizens in the overall improvement of the city (Kitchin 2016). Instead, nudges treat citizens as passive subjects who are prone to inertia and cognitive biases (Room 2016). For example, individuals tend to overestimate their success, be influenced by information that they were previously exposed to *(anchoring*) or by the first piece of information that comes to mind (*availability bias*).

By relying on data-driven nudges, cities convert citizens into consumers of public services, creating or reducing a demand for a public service through the personalization of messages, warnings or signals rather than adapting these services to the needs of citizens (Carolan 2018; Ranchordás 2018). This is nevertheless problematic for numerous reasons. Citizenship is based on pillars of rights and duties rather than on access to products based

on the idea of choice and economic access to goods and services. Influencing citizens so that they behave like consumers affects the agency of individuals and erodes their basic entitlements as citizens (Carolan 2018).

Data-driven nudges and other behavioral instruments are not in theory harmful for autonomy. It all depends on the type of nudge, whether individual choices are preserved, on the burden that default rules impose, and how decision-making is designed (Sunstein 2015a). Each nudge should be casuistically evaluated on the grounds of its underlying policy goals and the degree to which freedom of choice is preserved (Yeung 2012). If freedom of choice is not preserved, policymakers may be intruding in the individual's autonomy, setting rules that in face require legislative or regulatory powers that they may not have.

An alternative to the use of intrusive data-driven nudges could include participatory mechanisms that promote active engagement in smart cities and encourage citizens to embrace new responsibilities. These alternatives could also be regarded as new forms of governance that reduce traditional governmental intervention and initiative deliberative debates (Richardson et al. 2014). Recently, some smart cities (*e.g.* Barcelona) have started investing on the development of smart city governance, ethics, and security committees to guarantee the development of transparent data policies, build consensus around data ethical principles, improve the opportunities for citizen participation, and design ethical standards (NESTA 2018).

Behaviorally informed regulation and policy designed to inform citizens to live healthy and more environmentally friendly lives may have a more significant long-term effect as it is based on a conscious decision of participation. Stealth nudges, on the contrary, can be perceived as deceptive and illegitimate. The question whether full disclosure of these nudges is necessary to guarantee their legitimacy and ensure the protection of fundamental rights depends on the purpose of the nudge, the fundamental rights at stake, and the impact of the disclosure (Yeung 2016). The question of whether data-driven nudges are fair and legitimate also depends on the extent to which these nudges impose life-altering constraints on members of vulnerable, marginalized, and excluded groups (Gandy and Nemorin 2018). Another ethical issue which has been raised concerns the question of whether local governments should try to change the behavior of individuals when their acts are causing harms to others and not only to themselves (Oliver 2013).

An important shortcoming of nudging policies that should be taken into account refers to the fact that the effectiveness of information policies and nudges is seldom evaluated (Linder, Lindahl, and Borgström 2018). Because politicians have short-term horizons that do not match the time required for a significant behavior change in certain fields, nudges may also not be followed through after each political term. Nudges may thus require a very extensive process of data collection which may, at the end of the day, not deliver the desired long-term changes.

4.3. Conclusion: can the nudging city be trusted?

Behavioral insights can inform and improve the quality of law and policy at both national and local level. Data-driven predictions about human irrationality and cognitive biases can help public bodies advance the quality of their public services, help citizens make better decisions, and even reduce criminality (Amir and Lobel 2012). The Behavioral Insights

Team in the United Kingdom is an example of a growing government department that despite being connected to the Prime Minister's Cabinet Office, seeks to learn from local communities and their use of nudges (Burgess 2012). The combination of behavioral insights with smart governance at local level is consistent with the idea that more power should be devolved to local communities so that they can solve problems by adopting the approach that fits them the best. In addition, the adoption of this behavioral approach also shows the changes that cities have undergone. Urban centers face important environmental, mobility, housing, and social challenges which cannot only addressed by simply improving infrastructures. Instead, there is a growing need for new behaviors that change the city from within (BSI- PD8101 2014).

The fact that smart cities are embracing behavioral insights to improve their policies also shows the current importance of studying how behavioral science is reshaping urban law and governance. The combination of behavioral insights with smart technology allows policymakers to give a step in the direction of more systematic nudging as IoT, big data, and predictive analytics allow cities to make more accurate predictions and collect the required data to turn these predictions into recommendations. Nevertheless, smart technology and nudging may not be 'a match made in heaven.' Rather, the combination of citizen data with behavioral insights comes with a number of risks and concerns for both cities and citizens.

Data-driven nudges require an overwhelming collection of personal and impersonal data. While urban data may rarely interfere with citizens' right to privacy, data can be easily re-identified and used for profiling purposes. Therefore, this article has questioned smart cities' approach to widespread data collection and in particular the compatibility of data-driven nudges with the principles of transparency and data minimization.

In addition, this article has also highlighted that the smart technologies are rarely only provided or developed by public bodies. Rather, data-driven nudges often result from complex collaborative networks of public and private actors. In this context, there may be rare signs of citizen-centric policies and the citizen engagement and empowerment promised by smart cities. First, data-driven nudges do not yet engage citizens to participate actively in the formulation of behavioral goals. The 'nudger' is typically the city that will impose a nudging policy without consulting citizens on the grounds that nudges 'work better in the dark' (Bovens 2009). Moreover, recent research has shown that the use of technology for civic participation does not always close existing legitimacy deficits of the local representative government (Fung 2015). Second, smart technologies tend to be implemented by tech-savvy elites that wish to develop innovative ecosystems according to a technocratic rationale. However, the city does not only serve well-educated and entrepreneurial citizens that are interested in fast and efficient services. It also serves senior citizens and offline citizens who may not wish to be watched and then nudged 24/7.

The construction of a smart city is not a goal in itself. The same applies to the use of technology for nudging purposes. When employed by smart cities, data-driven nudges may become forceful tools for change in multiple socio-economic contexts. Nevertheless, these nudges contribute to a broader tendency of smart cities to collect large amounts of personal data, putting existing social norms, the rule of law, and the privacy of individuals under pressure (Tene and Polonetsnky 2013; NESTA 2018). Moreover, smart cities treat urban centers as homogenous and steerable machines, oversimplifying their complexity and overlooking the needs of their multiple stakeholders (Kitchin 2016). Data-driven

nudges magnify this tendency when city officials decide on what and who should be nudged without involving local communities. Citizens who are considered to be 'misbehavers' will be nudged more intensely than healthy and environmentally friendly individuals.

The combination of smart technology and behavioral insights may deliver better policy-making and more accurate predictions that can be of great value for example to the efficient allocation of public services. Nevertheless, efficiency is only one of the driving forces of a smart city. The other ones are technology and an informed citizenry. In this context, data-driven nudges may be compatible with the goals of a smart city if they benefit from greater consensus and democratic legitimacy, if they are subject to enhanced public scrutiny, incorporate the feedback of multiple stakeholders, and pass security and privacy impact assessments. At the time of writing, the current examples of data-driven nudges do not necessarily contribute to the creation of spaces of trust but rather to the development of spaces of constant surveillance where human agency is diluted in a technocratic discourse on welfaristic goals.

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